JRC 2024

Joint Rail Conference

Smart Technologies for Safer Railroads

CONFERENCE
May 13-15, 2024

University of South Carolina,
Columbia, SC

Program

https://event.asme.org/Joint-Rail-Conference

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Welcome Message From The Chairs

On behalf of the organizing committee, we are honored and delighted to welcome you to the Joint Rail Conference 2024. This year the conference comes back to the "famously hot" Columbia, the capital city of South Carolina where "beautiful places and smiling faces" is more than our state's motto, it is our way of life. We believe we have chosen a venue that guarantees a successful technical conference amid the culture and scenery of a thriving metropolis with a rich history that has emerged as a destination for meetings, conferences, and conventions in the south. Columbia is home to the University of South Carolina (USC), who is hosting the event in the Swearingen Engineering Center. The department of Civil and Environmental Engineering at USC and the Advanced Railway Technology Group (ARTGroup) is home to one of the newer comprehensive programs in Railroad Engineering in the country. With activities in research, education, and technology transfer related to railways, the Railway Engineering at USC has been contributing to workforce development and the advancement of knowledge, preparing, and thus, the new generation of industry leaders.

The theme of the conference is "Smart Technologies for Safer Railroads" and aligns with the strategic goals of the Federal Railroad Administration, the U.S. Department of Transportation, and the industry in general. This is a truly multidisciplinary conference that attracts international participants and is co sponsored by major technical organizations, the University Transportation Center for Railway Safety (UTCRS), and the University of South Carolina. Our technical program is rich and varied with two keynote speeches and nearly 100 technical papers, lectern presentations, and student poster presentations split among three parallel sessions each day covering all aspects of railroad. We are pleased to have Michael Cahill, President Rolling Stock Siemens Mobility, and Matthew G. Dick, P.E., Chief of Strategy and Development, ENSCO, Inc., as our keynote speakers discussing topics on the Technology Transformation of the Rail Industry. We are also pleased to welcome Joey Rhine, NTSB; Cameron Stuart, FRA; Dr. Brent Wilson, Hum Industrial Technology; and Dr. Alan Calegari, MERMEC Inc. to the panel of industry executives and federal agency representatives that will stimulate the discussion on engaging University faculty, research, and education to meet the Technology Transfer and Workforce Development needs of the railroad industry. The technical tour will provide technology demonstrations on the track of the historic SC Railroad Museum, as well as other opportunities that will give participants a platform for informal networking, to exchange ideas, and meet old and new friends.

As the JRC 2024 conference chairs, we know that the success of the conference depends on the delegates and ultimately on the many people who have worked diligently behind the scenes in planning and organizing both the technical program and supporting social arrangements. To all, we extend our sincere appreciation.

All of us at the JRC organizing committee, the University of South Carolina, the Advanced Railway Technology Group, and the local organizing committee are looking forward to welcoming you to Columbia and wish you a superb JRC 2024 conference experience and a memorable stay.

Dimitris Rizos
Conference Chair
University of South Carolina

Timothy Mast
Technical Program Chair
Wabtec Corporation

Constantine Tarawneh
University Outreach Chair
The University of Texas Rio Grande Valley

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General Information

ON SITE REGISTRATION AT THE UNIVERSITY OF SOUTH CAROLINA

HOURS:

Sunday, May 12
03:00 PM - 06:00 PM

Monday, May 13
12:30 PM - 04:30 PM

Tuesday, May 14
07:00 AM - 05:00 PM

Wednesday, May 15
07:00 AM - 05:00 PM

The following may register at the discounted Member rate(s) – Please contact Mary Jakubowski at jakubowskim@asme.org or onsite at the registration desk, if you are NOT a current ASME Member.

- ASME Members
- Authors, Session Chairs, Session Co-Chairs, Speakers
- ASME JRC Committee Members

Cooperating Societies include: APTA/ IEEE/ASCE/AREMA

UNIVERSITY INTERNET
Network Name: USCGuest

After launching a browser, the WiFi registration page appears.

Alternatively:
Users can access the registration page directly by clicking here:
https://wifi.sc.edu/guest/USCGuest_Cisco.php?_browser=1

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ASME VISION STATEMENT
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TECHNICAL CONFERENCE:

- Access to all Technical Sessions
- PDF of Final Program
- Program App
- Admission to the following networking events:
  - Session-Break Refreshments
  - Keynotes and Lunches
  - Reception and Awards Banquet
  - Opportunity to attend Technical Facility Tour

One-Day Includes:

- PDF of the Program
- Program App
- Meals on selected day
- Session-break refreshments on selected day

REGISTRATION REQUIREMENT:

Every published paper, presentation, and panel presentation must identify a designated presenter. Every presenter must register and pay the applicable conference fees. If not, the paper will not be included for publication in the proceedings and accompanying presentation information will be removed from the conference program.

CANCELLATIONS:

All cancellation requests must be made in writing and emailed. Cancellations made through April 12, 2024, will receive a full refund, less a $100 administration fee. Refunds will be made within four weeks of the end of the conference. Refunds are not available beginning April 13, 2024. "No shows" are not refundable and are liable for the full registration fee.

ASME TRAVEL POLICY:

ASME is not responsible for the purchase of non-refundable airline tickets, or the cancellation/change fees associated with canceling a flight. ASME retains the right to cancel a course/conference up until 3 weeks of the scheduled presentation date.

ASME PRESENTER ATTENDANCE POLICY:

Paper information should not be used for citation purposes. According to ASME's presenter attendance policy, if a paper is not presented at the conference, the paper will not be published in the official Archival Proceedings, which are registered with the Library of Congress, and are abstracted and indexed. The paper also will not be published in the ASME Digital Library and may not be cited as a published paper.

MEMBERSHIP:

All new registrants to the conference will receive a 4-month trial member. For everyone else, it is easy to apply, and the benefits include the fellowship and recognition from being associated with one of the largest engineering societies in the world. ASME members and student members, and members from select countries can receive a discount to the conference registration.

You can apply for ASME membership by registering online. Alternatively, you can call: 1-800-THE-ASME (800-843-2763) or outside North America 973-882-1167 and ASME will mail you an application, or you can e-mail to request an application.

For questions about the conference, hotel, and registration please contact:

Mary Jakubowski, CMP
Manager, Events Management
Tel: 212-591-7637
Email: jakubowskim@asme.org

"No shows" are not refundable and are liable for the full registration fee.

Please note: First time non-members who pay the full conference rate will be eligible for a 4-month trial membership in ASME. You can apply online by going to **https://www.asme.org/about-asme/professional-membership**.

PROFESSIONAL DEVELOPMENT HOURS RECORD FORMS

Participation record forms will be provided upon request to conference attendees who need to track their number of professional development hours (PDHs). Forms are available at the conference registration desk. Conferees should check the rules of their appropriate State licensing body to see if participation in this conference will qualify for credit to maintain a P.E. license or other professional certification.

TAX DEDUCTIBILITY

Expenses of attending professional meetings have been held to be tax deductible as ordinary business expenses for U.S. citizens. Because of changes in the tax code, the current level of deduction is subject to change.

CONFERENCE EVENTS

All attendees are encouraged to meet and discuss ideas with industry peers at the Conference Keynote, Plenary, Panel, and Awards Banquet, which features guest speakers on Tuesday and Wednesday. See schedule at a glance starting on page 6.

TECHNICAL TOUR

South Carolina Rail Museum / MERMEC Demonstration Technical Tour

Date: Monday, May 13, 2024
Time: 12:30PM–5:15PM*
Cost: $35.00 – Can be purchased online through the registration portal.
Maximum Attendees: 30

***Please meet at the registration desk in the Lobby of Swearingen Engineering Center(SWGN Lobby and Atrium) to board the bus by 12:30PM for a prompt departure. We will be back at the University at approximately 5:15PM. Transportation will be provided to/from the University.**

The tour to the SC Railroad Museum will give participants the opportunity to ride a vintage train along the line operated and maintained by the museum. The excursion includes a stop at a test site where participants will have the chance to engage in hand-on demonstrations of track inspection technologies by MERMEC Inc. engineers. The tour will conclude with a visit to the historic SC Railroad Museum.

The ASME Rail Transportation Division is entirely composed of volunteers from the railroad industry. If you are interested in participating, please contact Dimitris Rizos if you have any questions.

RECEPTION, AWARDS DINNER, AND KEYNOTE

KEYNOTE: MICHAEL CAHILL	**"THE ZONE" WILLIAMS-BRICE STADIUM**
TUESDAY, MAY 14, 2024	**6:00PM–9:00PM**

Please join us for a very special evening including a one-hour reception, followed by a plated dinner, our Award Ceremony, and our special Keynote, Michael Cahill, President, Rolling Stock at Siemens Mobility, North America. Shuttles will be available starting at 5:30PM until 9:30PM to/from the University to the Stadium. Please meet at the University lobby by 5:30PM for a 5:45PM departure. The Reception and Dinner is from 6:00PM-9:00PM. Complimentary Self-Parking is also available.

CONFERENCE MEALS

Breakfast, Lunch and Coffee Breaks will be served on Tuesday, May 14 and Wednesday, May 15 in the SWGN Lobby and Atrium. See schedule on page 7 and page 8 for times.

SPEAKER READY ROOM B102

	B102
MONDAY, MAY 13, 2024	**3:00PM–6:00PM**
TUESDAY, MAY 14, 2024	**7:00AM–5:00PM**
WEDNESDAY, MAY 15, 2024	**7:00AM–5:00PM**

EXHIBITORS

	SWGN LOBBY AND ATRIUM
TUESDAY, MAY 14, 2024	**10:00AM–5:00PM**
WEDNESDAY, MAY 15, 2024	**10:00AM–3:30PM**

Please remember to stop by our exhbitor tables and say hello, have a converstaion and ask some questions. There contributions to the conference were a tremendous help to make it sustainable. Lets show them our appreciation!

PUBLICATION SALES

All JRC Technical Papers are available electronically to registered attendees only. Attendees will receive electronic access via their e-mail on record. Additional copies of the JRC Proceedings can be ordered from:

ASME Order Department
150 Clove Road, 6th FL
Little Falls, NJ 07424-2139

Schedule-at-a-Glance

DAY 1: MONDAY, MAY 13, 2024

Start Time	12:30PM	12:30PM	3:00PM	5:30PM	6:30PM
End Time	4:30PM	5:15PM	6:00PM	6:30PM	8:30PM
	Registration **SWGN Lobby and Atrium**	SC Rail Museum / MERMEC Demos Technical Tour* ***Meet at Registration Desk in SWGN Lobby and Atrium at 12:15 PM**	Speaker Ready **Room B103**	JRC Organizing Committee Meeting **300 Main C217**	JRC Organizing Committee Dinner** ****By Invitation Only**

DAY 2: TUESDAY, MAY 14, 2024

Start Time	7:15AM	7:00AM	8:00AM	9:00AM	10:00AM
End Time	7:55AM	5:00PM	8:55AM	10:20AM	5:00PM
300 Main B213	Breakfast **SWGN Lobby and Atrium**	Speaker Ready **Room B103**	Welcome and Kickoff **SWGN 1C01 Amoco Hall** Plenary Session Matthew Dick (ENSCO)	Track 1-1A **B213**	Exihbits Open **SWGN Lobby and Atrium**
300 Main B103				Track 2-1 **B103**	
300 Main B201				Track 6-1 **B201**	

Start Time	10:30AM	11:00AM	12:30PM	1:30PM	3:00PM
End Time	10:55AM	12:20PM	1:20PM	2:50PM	3:25PM
300 Main B213	Coffee Break **SWGN Lobby and Atrium**	Track 1-2 **B213**	Lunch **SWGN Lobby and Atrium**	Track 1-1B **B213**	Coffee Break **SWGN Lobby and Atrium**
300 Main B103		Track 2-2 **B103**		Track 4-1 **B103**	
300 Main B201		Track 3-1 **B201**		Track 6-2 **B201**	

Start Time	3:30PM	6:00PM
End Time	5:00PM	9:00PM
300 Main B213	Student Poster Session **Faculty Lounge**	Reception, Awards Dinner, and Keynote **Michael Cahill (Siemens)** **"The Zone"** **Williams-Brice Stadium**
300 Main B103		
300 Main B201		

DAY 3: WEDNESDAY, MAY 15, 2024

Start Time	7:15AM	7:00AM	8:00AM	9:00AM	10:00AM
End Time	7:55AM	5:00PM	8:55AM	10:20AM	3:30PM
300 Main B213	Breakfast **SWGN Lobby and Atrium**	Speaker Ready **Room B103**	Technology Transfer and Workforce Development Panel **SWGN 1C01 Amoco Hall**	Track 1-3 **B213**	Exihbits Open **SWGN Lobby and Atrium**
300 Main B103				Track 2-3 **B103**	
300 Main B201				Tracks 6-3, 8-3 **B201**	

Start Time	10:30AM	11:00AM	12:30PM	1:30PM	3:00PM
End Time	10:55AM	12:20PM	1:20PM	2:50PM	3:25PM
300 Main B213	Coffee Break **SWGN Lobby and Atrium**	Track 1-5A **B213**	Lunch **SWGN Lobby and Atrium**	Track 1-4 **B213**	Coffee Break **SWGN Lobby and Atrium**
300 Main B103		Track 3-2 **B103**		Track 2-4 **B103**	
300 Main B201		Track 6-4 **B201**	ASME Rail Transportation Division Meeting **C217**	Tracks 5-1, 7-1, 8-1 **B201**	

Start Time	3:30PM
End Time	4:50PM
300 Main B213	Track 1-5B **B213**
300 Main B103	Tracks 2-5, 8-2 **B103**
300 Main B201	Track 6-5 **B201**

2024 JOINT RAIL CONFERENCE WELCOME ADDRESS & PLENARY

Tuesday, May 14, 2024 - 8:00 AM – 8:55 AM
SWGN 1C01 Amoco Hall

Matthew Dick, P.E.
Chief of Strategy and Development, ENSCO, Inc.

Matthew Dick is the Chief of Strategy and Development at ENSCO. Matthew held previous roles during his fourteen years at ENSCO including Rail Division Manager. In the current role, Matthew is leading ENSCO's development of expanded service and solution offerings including at the Transportation Technology Center (TTC) and ENSCO's subsidiary KLD Labs, Inc. Matthew Dick received his B.S.M.E and M.S.M.E. from the University of Nebraska–Lincoln and has his professional engineering license. He has been involved with railroad research and technology for over 20 years in the areas of vehicle/track interaction, derailments, and inspection technology. Matthew is Chair Emeritus of AREMA Committee Two "Track Measurement and Assessment Systems" and is a previous Chair of the ASME Rail Transportation Division.

This plenary speech will discuss the critical role that academic research has in the railway industry, including discussion of case studies, lessons learned, and insights to career growth in the rail industry. Additionally, this plenary speech will discuss the next generation Transportation Technology Center (TTC) located in Pueblo Colorado and its new role in supporting academic institutions in their pursuit of advancing research in the railway industry. The speech will include discussion of capabilities, case histories, and future vision of the partnership between the TTC and academic institutions. The speech will include time for Q&A to provide additional insights and perspectives.

Matthew G. Dick, P.E.

Chief of Strategy and Development, ENSCO, Inc.

Plenary Speaker

Tuesday, May 14, 2024
8:00 AM – 8:55 AM

SWGN 1C01 Amoco Hall

2024 JOINT RAIL CONFERENCE AWARDS DINNER & KEYNOTE SPEAKER

Tuesday, May 14, 6:00 PM – 9:00 PM
SWGN 1C01 Amoco Hall

Michael Cahill
President, Rolling Stock, Siemens Mobility, North American

Michael Cahill is president of Siemens Mobility's Rolling Stock business for North America. In this role, he manages the operational and commercial activities across the entire spectrum of rolling stock including commuter and regional passenger trains, light rail and streetcars, metros, locomotives, passenger coaches, and high-speed trainsets.

With more than 25 years of experience at Siemens, Cahill began his career as a commissioning engineer working in Germany, the United States, Italy, and South Korea. He has held several leading positions in project management for the Siemens Transportation Systems business and currently oversees the activity of Siemens Mobility's North American Manufacturing Headquarters for Rolling Stock based in Sacramento, California. With over 2400 employees and in operation for more than 30 years, the plant designs and manufactures advanced rail equipment for customers across the U.S. and North America.

Cahill studied electrical engineering at the University College Dublin

Abstract:
Across the globe and right here in the United States, rail travel is undergoing a transformation. With exciting new technologies like hydrogen and battery power, new innovations in passenger comfort and exciting expansions in rail manufacturing, Siemens Mobility is transforming rail right here in the USA. Hear from Siemens Mobility's North America President of Rolling Stock, Michael Cahill, as he discusses what's next in American rail.

Michael Cahill

President, Rolling Stock,

Siemens Mobility, North America

Keynote Speaker

Tuesday, May 14, 2024
6:00 PM – 9:00 PM

SWGN 1C01 Amoco Hall

Moderator:

Constantine Tarawneh, PhD

University Transportation Center for Railway Safety (UTCRS)

Panel Session

Wednesday, May 15, 2024 8:00 AM – 8:55 AM

2024 JOINT RAIL CONFERENCE PANEL SESSION

Wednesday, May 15, 2024 - 8:00 AM – 8:55 AM
SWGN 1C01 Amoco Hall

TECHNOLOGY TRANSFER AND WORKFORCE DEVELOPMENT PANEL

Moderator:

Constantine Tarawneh, PhD
University Transportation Center for Railway Safety (UTCRS)
The University of Texas Rio Grande Valley (UTRGV)

Panelists:

Joey Rhine
National Transportation Safety Board

Joshua Marschke
Director Standards & Capital Planning, CSX

Brent Wilson
CTO, Hum Industrial Technology

Alan Calegari
Chairman of the Board, President, MERMEC, Inc.

Dimitris Rizos
Conference Chair
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Timothy Mast
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Thank You!

The University of Texas Rio Grande Valley

UNIVERSITY TRANSPORTATION CENTER FOR RAILWAY SAFETY

TUESDAY, MAY, 14
SWGN LOBBY AND ATRIUM
3:30PM–5:00PM

01
FEATURE EXTRACTION FROM VIBRATION SIGNATURES ACQUIRED FROM RAILROAD BEARING ONBOARD CONDITION MONITORING SENSOR MODULES

Kevin Quaye[1] (Presenter), Albert Gonzalez[1], Ping Xu[1], Dimah Dera[2], Heinrich Foltz[1], Constantine Tarawneh[1]

[1]The University of Texas Rio Grande Valley, Edinburg, TX
[2]Rochester Institute of Technology, Rochester, NY

From 2013 to 2022, 1671 derailments have been reported by the Federal Railroad Administration (FRA), 8.2% of which were due to journal bearing defects. The University Transportation Center for Railway Safety (UTCRS) designed an onboard monitoring system that tracks vibration waveforms over time to assess bearing health through three analysis levels. However, the speed of the bearing, a fundamental parameter for these analyses, is often acquired from Global Positioning System (GPS) data, which is typically not available at the sensor location. To this end, this research proposes to employ Machine Learning (ML) algorithms to extract the speed and other essential features from existing vibration data, eliminating the need for additional speed sensors. Specifically, the proposed method tries to extract the speed information from the signatures that are embedded in the Power Spectral Density (PSD) plot, which enables rapid real-time analysis of bearings while the train is in motion. The rapid extraction of data could be sent to a cloud accessible by train dispatchers and railcar owners for assessment of bearings and scheduling of replacements before defects reach a dangerous size. Eventually, the developed algorithm will reduce derailments and unplanned field replacements and afford rail stakeholders more cost-effective preventive maintenance.

02
NEXT GENERATION ONBOARD SENSOR TECHNOLOGIES FOR ROLLING STOCK

Dario Hinojosa (Presenter), Constantine Tarawneh, Heinrich Foltz

The University of Texas Rio Grande Valley, Edinburg, TX

Train derailments like the one in East Palestine, Ohio, on February 3, 2023, result in costly economic damages and devastating societal effects. In the East Palestine incident, Hot Bearing Detectors (HBDs) captured the increase in bearing temperature at three separate locations ahead of the derailment site; however, the third reading which exceeded the threshold was not obtained until the bearing had started to catastrophically fail. HBDs are reactive in nature since they rely on temperature to access bearing health. Studies have shown that bearings exhibit high operating temperatures near catastrophic failure, allotting little time to implement preventative measures. Vibration-based sensors have been proven to detect early stages of bearing defect development. Hence, wireless onboard sensors pose a solution to prevent derailments by continuously monitoring rolling stock and allowing preventative measures to be scheduled. This project aims to develop the next-generation of sensors through optimal filters, higher resolution analog-to-digital conversion, and precision synchronization of all sensors on the same car compared to their previous counterpart. Precise synchronization enables separation of vibrations originating in one bearing from vibrations arising in adjacent bearings, wheels, brakes, track, and couplers. This enables more accurate monitoring of bearing condition and identification of other problems on the railcar or track.

03
POWERING ONBOARD BEARING HEALTH MONITORING SENSORS WITH THERMOELECTRIC GENERATORS UNDER NON-UNIFORM TEMPERATURES

Presenter: Carlos Rodriguez Danna Capitanachi, Gael de Leon, Constantine Tarawneh, Heinrich Foltz

The University of Texas Rio Grande Valley, Edinburg, TX

Wireless onboard health monitoring devices are a promising preventive technology that can be included in the surveillance of train rolling stock. These devices can detect the early stages of bearing and wheel defects. However, the nature of continuous monitoring requires an energy source sufficient to record and transmit data. Thermoelectric energy harvesting is an effective solution to power onboard wireless condition monitoring sensors during railroad operations. Thermoelectric Generators (TEGs) are considered to be environmentally safe, are static and simple structures, and require little maintenance. TEGs can fill a crucial role in providing energy to run vibration and temperature sensors, as well as supporting LoRa communications. However, when mounted on a railcar, TEGs may be subjected to non-uniform temperature differentials caused by the forced convection generated by air motion relative to the vehicle. It can be shown that TEGs experiencing non-homogeneous temperatures can have reduced power output, and if the temperature difference is large, power is further reduced than with one TEG alone. This work presents analysis and experimental data comparing several possible design solutions: (1) a simple series connection, (2) a series connection with bypass diodes, and (3) isolated TEGs with separate boost converters for each module.

04

EVALUATING FEASIBILITY OF GEOPHONE TECHNOLOGIES FOR ENERGY HARVESTING ON ROLLING STOCK

Presenter: Andres Salinas

Amanda Rodriguez, Heinrich Foltz, Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

Bearing failure continues to be one of the leading causes of train derailments that result in significant economic and environmental damages. To prevent these tragedies, researchers at the University Transportation Center for Railway Safety (UTCRS) are developing wireless onboard condition monitoring systems that can detect bearing defects preemptively by tracking the vibration signature emissions continuously. These systems utilize a rechargeable battery that can provide up to two years of operation on a single charge. However, a suitable energy harvesting system can significantly increase the batteries' longevity or allow for more frequent data collection and reporting. The main objective of the research presented here is to explore the feasibility of utilizing existing geophone technologies as an alternative energy harvesting approach for the onboard bearing condition monitoring system. The proposed method involves mounting a geophone device on a bearing adapter to harvest vibration-based energy produced by the rolling stock. By enhancing the reliability and safety of rail transportation networks, this research can help mitigate the risks associated with bearing failures and improve the overall safety of railway operations.

05

LINUX-BASED DAQ SYSTEM FOR TESTING RAILROAD BEARINGS IN A LABORATORY SETTING

Presenter: Marcelo Cavazos

Rogelio Salinas

The University of Texas Rio Grande Valley, Edinburg, TX

An innovative data acquisition and monitoring system designed to enhance the efficiency, reliability, and safety of railroad bearing testing within a laboratory setting is presented. The system comprises five distinct testers, each interfaced with a dedicated Linux computer equipped with LabVIEW™ for conducting wired tests, and custom-developed software for wireless connectivity to a specially designed module by the electrical engineering team. The core of the system lies in its capability to autonomously collect 5,200 samples from each module every 10 minutes, ensuring comprehensive data acquisition. To accommodate users of varying technical expertise, the software features both a graphical user interface (GUI) for ease of use and a headless mode for command line users. A unique aspect of the system is its integrated database infrastructure, which not only stores data locally on each tester but also synchronizes with a central "whiteboard" database. The whiteboard, a Linux-based computer with expanded storage capabilities, serves as a nexus for aggregating data from all testers. Additionally, it supports security and monitoring efforts by displaying live camera feeds from the testing environments. This system represents a significant advancement in bearing testing technology, providing a robust, user-friendly, and scalable solution for real-time data collection and analysis.

06

INCREASING STABILITY OF BEARING APPLIED LOAD DURING DYNAMIC TESTING

Presenter: Rogelio Salinas

Heinrich Foltz, Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

A major activity at the University Transportation Center for Railroad Safety (UTCRS) is performance evaluation of freight railcar bearings using laboratory test rigs that closely simulate service operating conditions. A hydraulic system applies load to the bearings through the adapters, with controllable force ranging from that of an unloaded railcar to 125% of the maximum allowed load capacity. One issue in laboratory testing is variation in the applied load due to thermal expansion and contraction of the hydraulic fluid within the cylinder. To remedy this problem, a load controller that can adjust the force applied by the hydraulic cylinder to counteract thermal effects was designed and built. The fabricated load controller is a completely analog device with user adjustable controls for set point, sensitivity, and maximum load rate. It controls a motor driven lead screw and auxiliary cylinder that are used to adjust the main cylinder pressure. It has a manual mode, where the motor and lead screw are adjusted directly by the user. Most important, however, is the automatic mode, which controls the load set point with an adjustable dead band to reduce hunting that could shorten motor life. Future versions of this controller will allow the user to program specific load profiles, be under digital control, and have connectivity features.

07

AUTOMATED CURVATURE CALCULATION ALGORITHM IN RAIL NEUTRAL TEMPERATURE MEASUREMENT SYSTEM

John Stormes (Presenter), Emerson Mitchell, Dimitros Rizos

The University of South Carolina, Columbia, SC

Researchers at the University of South Carolina have developed a non-contacting, reference-free technology for estimating the rail neutral temperature (RNT). The technology is based on deformation measurements of the top of rail (TOR) and the web. It is a non-contacting, reference free technique that has been validated in the laboratory and the field. RNT estimates are obtained by correlating changes in curvature of the TOR to temperature. The TOR deformations may be captured by stereo digital image correlation (stereoDIC) systems or high-resolution 3D laser profilers. Both techniques produce a point cloud in the 3D space that defines the TOR surface at different temperatures. The authors have developed an automated curvature calculation algorithm that automates the calculation of the required curvatures and optimizes the evaluation of the RNT. The method is based on a weighted sum approximation and least square regression and has shown excellent performance in reducing noise in the measurements.

08
A REVIEW OF REQUIREMENTS TO OPTIMIZE THE USE OF DIGITAL IMAGE CORRELATION (DIC) FOR MONITORING RAIL INFRASTRUCTURE

Stephen Wilcken (Presenter), Dimitros Rizos

The University of South Carolina, Columbia, SC

A crucial aspect of safe and efficient operation of railway infrastructure is proper maintenance and inspection. Information on the condition of this infrastructure needs to be quickly and accurately determined through testing, ideally in a non-destructive and non-disruptive way. Digital Image Correlation (DIC) is a non-destructive, non-disruptive, and uniquely non-contacting testing method that has been developed in the USC laboratories over the last thirty years. DIC captures full field shape, deformations, and displacements through the acquisition and analysis of optical images. The Advanced Railway Technology Group at USC has introduced the DIC technology in the rail industry. DIC has been successfully implemented in rail neutral temperature (RNT) measurements, in the quality control of prestressed concrete crossties, including transfer length measurements, for material testing, and the structural assessment and monitoring of main girders of rail bridge. The effective use of DIC in such applications in the field that will maintain the high accuracy and reliability of the technology poses challenges with respect to: (i) the application of a speckle pattern on the area of interest (AOI), (ii) the varying lighting conditions of the AOI, and (iii) a stable and rigid camera hardware configuration that eliminates the adverse effects of vibrations. This presentation introduces the implementation requirements of the DIC technology in rail infrastructure monitoring and presents the solutions proposed by the research team to alleviate the challenges encountered in the field applications.

09
DEVELOPMENT OF RAIL ANCHOR TESTING THROUGH LITERATURE REVIEW OF CWR BUCKLING RESISTANCE EVALUATION

Teresa Salazar-Flores (Presenter), Juan Rodriguez, Siang Zhou, Mustapha Rahmaninezhad, Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

Continuously welded tracks (CWR) are among the most used railroad systems worldwide with great improvements compared to jointed tracks. Rail buckling is one of the key remaining issues for CWRs to further reduce safety hazards and infrastructure deterioration. CWR buckling results from a combination of longitudinal, lateral, and torsional forces acting on the track due to various factors such as rail components, moving train loads, track-substructure interaction, and thermal variations. An in-depth study of factors affecting rail stiffness (longitudinal, lateral, and torsional) is crucial to comprehend rail buckling and improve buckling resistance on CWR. This work summarizes and interprets existing research related to rail buckling resistance, considering parameters such as time-dependent neutral temperature of the tracks, the type of trains, various track resistors (rails, sleepers, and ballasts), and other accessories (anchors and fasteners). A discussion of previous experiments that studied resistors and rail buckling resistances is presented, which guides development of an experimental arrangement as part of an ongoing large-scale rail resistance testing project at UTCRS-UTRGV. The information summarized here identifies additional needs for experimental and numerical studies and provides structured background for prospective improvements on rail buckling and stiffnesses of CWR.

10
DESIGN AND TESTING OF FULL-SCALE TRACK PANEL PUSH TEST

Santana Gutierrez (Presenter), Mustapha Rahmaninezhad, Siang Zhou, Constantine Tarawneh

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For the past 40 to 50 years, the railway industry has increasingly focused on continuous welded rail (CWR) as a replacement for jointed tracks. The absence of rail joints in CWR systems increases the risk of thermal expansion-induced track buckling, which can result in catastrophic derailments and poses a significant safety concern. Longitudinal track resistance can play a critical role in ensuring track stability and minimizing temperature-induced rail stress damage. Rail anchors have long been used to enhance the longitudinal track resistance. Rail-tie anchors serve a multifaceted purpose in track stability, while they do distribute longitudinal or rotational loads to the ties, they also play a pivotal role in managing Rail Neutral Temperature (RNT). Although some investigations have been done on the longitudinal resistance of CWR tracks, there have been few comprehensive investigations that have isolated the influence of steel anchors on the longitudinal resistance of the rail-tie interface. The design and construction of a full-scale laboratory experimental track panel push test (TPPT) setup to assess the efficacy of rail anchors on longitudinal track resistance are presented along with some results acquired from the initial testing of TPPT evaluating several rail-anchor loading configurations.

11
MULTIVARIATE CALIBRATION FOR AN ONBOARD LOAD SENSOR IN A SHEAR ADAPTER PAD ASSEMBLY

Diego Aguila (Presenter), Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

To fully characterize the health condition of a railroad bearing, three parameters must be tracked and measured. These are temperature, vibration, and applied load. Currently, there are onboard monitoring sensors that can track and record the temperature and vibration profiles, however, there are no onboard sensors that can accurately and reliably measure the load applied on each bearing within the railcar. Hum Industrial Technology, Inc., alongside researchers at the University Transportation Center for Railway Safety (UTCRS) are working on developing and deploying a prototype onboard load sensor for both static and dynamic operating conditions. This research aims to make this sensor ready for field applications by implementing a means to compensate for the effects of bearing operating temperature on the strain gauge. This temperature calibration is essential for effective functionality of the load sensor and to ensure the accuracy and efficacy of the sensor during dynamic rail service operation where the bearing operating temperature will fluctuate significantly depending on the railcar operating load and speed. This endeavor is well-aligned with the USDOT strategic goal of enhancing the safety and efficiency of railroad operations.

12
EXPERIMENTAL INVESTIGATION OF LATERAL LOAD EFFECTS ON RAILWAY TAPERED ROLLER BEARING PERFORMANCE

Abel David Sanchez Trinidad (Presenter), Constantine Tarawneh, Arturo Fuentes

The University of Texas Rio Grande Valley, Edinburg, TX

When a freight train railcar is at rest, the wheelsets and their bearings bear the weight and stress in a primarily static, radial loading. However, when set into motion, the scenario changes significantly due to the inherent imperfections in rail tracks and the presence of curves or turns in various locations. These imperfections can cause the loaded railcar to shift from side to side, subjecting the bearings to lateral forces. Surprisingly, limited research has been carried out or made publicly available on the effects of lateral loading on the performance of railroad tapered-roller bearings under various train speeds at empty and full railcar loads. Motivated by this, researchers at the University Transportation Center for Railway Safety (UTCRS) are conducting laboratory testing utilizing the available dynamic bearing test rig to explore the effects of lateral loading on bearing performance. The laboratory testing is designed to mimic lateral forces that bearings will experience during events like hunting, buckled track, uneven track, and instances where trains are navigating curved sections of track. The results of this study are expected to inform rail operators on the effects of lateral loads on bearing operating temperature and vibration levels with the goal of optimizing rolling stock condition monitoring technologies.

13
INACTIVE BEARING PERFORMANCE CHARACTERIZATION STUDY

Curtis Pena (Presenter), Constantine Tarawneh, Robert Jones

The University of Texas Rio Grande Valley, Edinburg, TX

Railroad tapered roller bearings rely on grease to reduce friction and wear and to cool the components during dynamic operation. When the bearing is static for a prolonged period, the base oil and thickener may begin to separate, affecting cooling and anti-friction properties. The potential for such changes to impact bearing performance and reliability has led researchers at the University Transportation Center for Railway Safety (UTCRS) to investigate this aspect of bearing operational history to assess the performance of tapered roller bearings that have experienced long periods of inactivity while railcars are parked in railyards. A dynamic four bearing tester (4BT) designed by the UTCRS simulates operating conditions for bearing life assessment while differential scanning calorimetry (DSC) and standard grease characterization and viscosity measures are used to understand the effects of inactivity on the grease. The study includes bearings with varying storage durations and environments and assesses bearing performance, lubricant quality, and performance, and bearing component degradation. Understanding the effects of prolonged storage on bearing performance can guide maintenance protocols, contributing to the reliability, longevity, and safety of rolling stock bearings.

14
OPTIMIZED VIBRATION-BASED HEALTH METRICS FOR FREIGHT RAIL BEARINGS

Dylan Rocha (Presenter), Constantine Tarawneh, Jeffery Pams, Alberto Diaz Jr.

The University of Texas Rio Grande Valley, Edinburg, TX

In the railroad industry, monitoring the condition of freight railcar bearings in-service is carried out through two primary systems: wayside hot bearing detectors (HBDs) and trackside acoustic detection systems (TADS™). However, these systems face challenges in accurately assessing bearing fatigue and distress, especially during initial defect stages. To address this, the University Transportation Center for Railway Safety (UTCRS) developed a wireless onboard condition monitoring technology. Unlike existing methods, this system continuously monitors in-service bearings, offering precise health assessments. It utilizes calibrated vibration thresholds based on correlations between bearing operating speeds and vibration signatures for healthy and defective bearings. Additionally, the system identifies faulty components in tapered-roller bearings through frequency domain analysis. To maintain accuracy of the onboard sensors in detecting defective components, the thresholds are periodically reassessed by employing regression analysis to establish revised thresholds that incorporate the latest vibration data collected from laboratory testing of healthy and faulty bearings. These revised thresholds can enhance the health monitoring of in-service bearings, enabling rail operators to identify issues early, schedule maintenance, and prevent costly and unnecessary train stoppages. This research aims to improve bearing health monitoring in the railroad industry, ultimately reducing catastrophic derailments and associated human and capital losses.

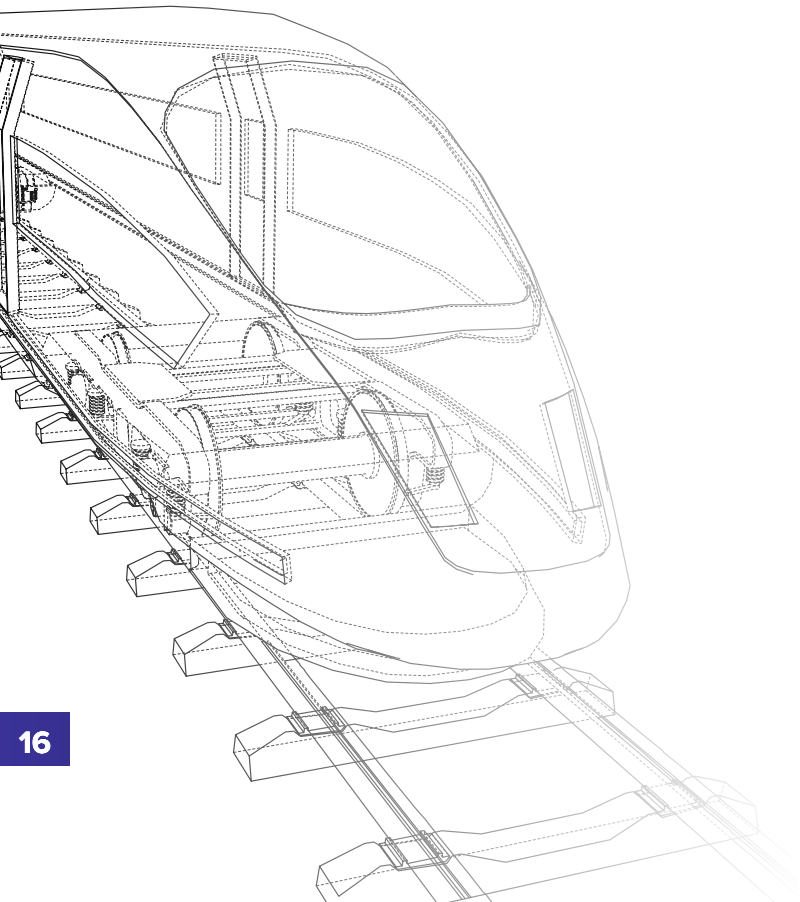
15
RAILROAD TRACK AND WHEEL DETECTION WITH ONBOARD CONDITION MONITORING SYSTEM

Presenter: Jeffery Pams[1]

Constantine Tarawneh,[1] Brent Wilson,[2] Lee Cantu[2]

[1]The University of Texas Rio Grande Valley, Edinburg, TX
[2]HUM Industrial Technology, Inc., St. Louis, MO

The Federal Railroad Administration's (FRA) Office of Safety Analysis estimates that over 1,000 train derailments occur every year in the United States, with a significant number being caused by mechanical failures such as defects within the wheels and tracks. The use of wireless onboard health monitoring technologies has been receiving attention after recent catastrophic derailments. Through research, development, and implementation of onboard condition monitoring systems by the University Transportation Center for Railway Safety (UTCRS) and HUM Industrial Technology, Inc., a promising method to detect wheel and track defects has been field tested in freight revenue service. HUM's onboard condition monitoring system, which includes the Boomerang (the onboard module with a suite of sensors), and the Gateway (the wireless communication module), has improved the visibility of data pertaining to railcar operating conditions by measuring vibrations generated by the bearings, wheels, and wheel-track interactions. By correlating these data to measured vehicle speed and GPS locations, the data pertinent to wheel and track aberrations can be parsed and verified against known defect signatures of each component or track. This study highlights the capabilities of onboard condition monitoring systems for determining in situ wheel defects and extrapolations to track defects and low-speed defect monitoring.



16
HEALTHY AND DEFECTIVE TAPERED ROLLER BEARING TEMPERATURE METRICS

Presenter: Samantha Garcia

Mia Adame, America Martinez, Curtis Pena, Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

The safe and efficient transport of freight in the railway industry relies heavily on monitoring bearings and wheels. Bearing seizures remains a significant concern, capable of causing catastrophic train derailments. This underscores the critical need for effective monitoring practices. Wayside detection devices like Hot Bearing Detectors (HBDs) and Trackside Acoustic Detection Systems (TADS™) monitor, respectively, bearing temperatures and acoustic emissions as trains pass. However, these systems have shown inaccuracies in fault detection, resulting in unnecessary and costly train stoppages and delays. Additionally, bearing operating temperatures can exhibit random trends due to roller misalignments, even without defects. This study aims to provide comprehensive bearing operating temperatures for healthy and defective bearings under typical rail service conditions. It includes two decades of laboratory experiments on AAR Class F and K railroad bearings, covering bearings with defective cup (outer ring) and cone (inner ring) raceways of varying severity. Intriguingly, the data show that bearings with relatively small defects operate at temperatures similar to healthy bearings. This raises concerns about HBDs' ability to detect faulty bearings in time for preventive maintenance. Nonetheless, the data offer valuable insights into healthy and defective bearing temperature metrics for the rail industry.

17
MEASURING GEOMETRIC TOLERANCE CHANGES IN RECONDITIONED RAILROAD BEARING RACEWAYS

Presenter: Diego Leal

Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

Railway maintenance has a major impact on the safety and efficiency of train operations. Among the critical components are bearing raceways within the cup (outer ring), where geometric tolerances are crucial for optimal performance. This project focuses on investigating the geometric tolerances of railroad bearing raceways after they have been reconditioned. Currently, a simple test setup is being utilized that allows the measurement of geometric concentricity of bearing outer ring (cup) raceways. Preliminary measurements of new, lightly used, and reconditioned bearing cups indicate that raceways of reconditioned bearings exhibit higher than normal geometric concentricity, especially near the spacer ring region. These tolerance deviations can compromise the integrity of bearing raceways, leading to increased friction and wear, which can ultimately result in bearing burn-off and train derailment. Understanding the reasons behind these geometric concentricity issues present in reconditioned bearings is key to implementing corrective measures to this process to ensure the safety and reliability of freight rail service. Future work will involve devising a sophisticated setup integrating precise LVDTs so that exact measurements of raceway geometric concentricity can be acquired and mapped.

18
ONBOARD CONDITION MONITORING SENSOR MODULE INSTALLATION ON RAILROAD BEARING ADAPTERS

Presenter: Daniel Reyna

Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

With the adoption of onboard condition monitoring technologies on the rise, installation of these devices on freight railcars presents a challenge given the variations in bogie configurations in rail revenue service. Since sensors cannot be affixed to the bearing itself due to the possible indexing of the bearing outer ring (cup) during dynamic operation, the bearing adapter is commonly utilized for the installation of the sensor modules. The bearing adapter is the component on the railcar suspension system (bogie) that mates the bearing with the side frame. The work presented here aims to provide detailed steps on the installation of the HUM Boomerang – a wireless onboard condition monitoring sensor module developed by HUM Industrial Technology, Inc., in partnership with the University Transportation Center for Railway Safety (UTCRS) – on the bearing adapter. The installation involves machining the adapter to accept the sensor module while ensuring that: (1) the sensors are properly aligned, and (2) the sensor module is rigidly attached to the adapter to mitigate any relative motion that can affect the acquired vibration signatures. Methods used to optimize the installation process for time and effort are also presented.

19
KERNEL RIDGE REGRESSION IN PREDICTING RAILWAY CROSSING ACCIDENTS

Presenter: Ethan Villalobos[1]

Jia Chen,[2] Evangelos E. Papalexakis,[2] Ping Xu,[1] Constantine Tarawneh[1]

[1]The University of Texas Rio Grande Valley, Edinburg, TX
[2]University of California, Riverside, Riverside, CA

Expanding on insights gained from an initial investigation into railway accident patterns by the authors, the current research delves deeper into the predictive capabilities of machine learning to forecast potential accident trends in railway crossings. Focusing on critical factors such as "Highway User Position" and "Equipment Involved," Kernel Ridge Regression (KRR) models tailored to distinct clusters are integrated, as well as a global model for the entire dataset. These models, trained on historical data, discern patterns and correlations that might elude traditional statistical methods. The findings are compelling: certain clusters, despite limited data points, showcase remarkably root mean squared error (RMSE) values between predictions and real data, indicating superior model performance. However, certain clusters hint at potential overfitting, given the disparities between model predictions and actual data. Conversely, clusters with vast datasets underperform compared to the global model, suggesting intricate interactions within the data that might challenge the model's capabilities. The performance nuances across clusters emphasize the value of specialized, cluster-specific models in capturing the intricacies of each dataset segment. This study underscores the efficacy of KRR in predicting future railway crossing incidents, fostering the implementation of data-driven strategies in public safety.

20
SPECTRAL CLUSTERING IN RAILWAY CROSSING ACCIDENTS ANALYSIS

Presenter: Miguel Gutierrez[2]

Ethan Villalobos,[1] Biqian Cheng,[2] Ping Xu,[1] Jia Chen,[2] Evangelos E. Papalexaki,[2] Constantine Tarawneh[1]

[1]The University of Texas Rio Grande Valley, Edinburg, TX
[2]University of California, Riverside, Riverside, CA

This study employs graph mining and spectral clustering to analyze patterns in railway crossing accidents, utilizing a comprehensive dataset from the U.S. Department of Transportation. By constructing a graph of implicit relationships between railway companies based on shared accident localities, spectral clustering is applied to identify distinct clusters of companies with similar accident patterns. This offers nuanced insight into the underlying structure of these incidents. The results indicate that "Highway User Position" and "Equipment Involved" play pivotal roles in accident clustering, while temporal elements like "Date" and "Time" exert a diminished impact. This research not only sheds light on potential accident causation factors but also sets the stage for subsequent predictive safety analyses. It aims to serve as a cornerstone for future studies that aspire to leverage advanced data-driven techniques for improving railway crossing safety protocols.

21
AI-BASED HAZARD DETECTION FOR RAILWAY CROSSINGS

Presenter: Darren Espinoza

Gasser Ali, Constantine Tarawneh

The University of Texas Rio Grande Valley, Edinburg, TX

Grade crossings are vital components of railway infrastructure. However, potential risks of collisions between vehicle-train and human-train are of concern. In 2020 alone, the National Highway Traffic Safety Administration (NHTSA) recorded over 1,600 vehicle-train collisions and 500 human-train collisions. Efforts by researchers, scientists, transportation companies, and government agencies have explored methods such as sensors, barriers, motion detectors, and cameras. The research presented here aims to apply deep learning (DL) and artificial intelligence (AI) techniques to enhance rail grade crossing safety. The devised DL model aims to offer robust, cost-effective, and reliable ability to detect hazards at grade crossings, under any environmental, lighting, and weather conditions. Development of the model will be accomplished with a dataset of labelled images captured at grade crossings by the authors. The DL model aims to provide detection of hazardous conditions at grade crossings consisting of wildlife, vehicles, and pedestrians for the sole purpose of preventing dangerous operating conditions.

TECHNICAL PRESENTATIONS CAN BE FOUND IN THE CONFERENCE APPLICATION (APP.)

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Constantine	Tarawneh	Technical Paper Publication	130045	Feature Extraction From Vibration Signature Required From Railroad Bearing Onboard Condition Monitoring Sensor Modules	Track 1-4: Condition Monitoring	5/15/24	1:30 PM	2:50 PM	300MN B213
Justin	Theriaut	Technical Presentation Only	136485	Using AI and Machine Learning for Rail Lidar Processing at Scale	Track 1-5B: Track Safety	5/15/24	3:30 PM	4:50 PM	300MN B213
Keivan	Torabi	Technical Paper Publication	120875	Streamlining System Assurance Program Objectives and Compliance With Both European and American Standards by Early Integration	Track 6-3: Rolling Stock Safety and Policies	5/15/24	9:00 AM	10:20 AM	300MN B201
Stuart F	Trout	Technical Paper Publication	125411	Passenger Railcar Production in North America: Rationalization and Standardization	Track 2-5: Rolling Stock and Dynamics	5/15/24	3:30 PM	4:50 PM	300MN B103
Joseph	Turner	Technical Presentation Only	125267	Ultrasonic Nondestructive Quantification of Case Depth in Railroad Bearings: Statistical Analysis and Machine Learning Predictions	Track 2-2: Rolling Stock and Dynamics	5/14/24	11:00 AM	12:20 PM	300MN B103
Joseph	Turner	Technical Presentation Only	130021	Rolling Contact Fatigue Performance of Railroad Bearing Rollers Manufactured Using Laser Powder Bed Fusion	Track 2-2: Rolling Stock and Dynamics	5/14/24	11:00 AM	12:20 PM	300MN B103
Samuel	Vellequette	Technical Presentation Only	130210	Using Waam to Locally Enhance Fatigue and Corrosion Resistance of Cast Steel Parts	Track 2-4: Rolling Stock and Dynamics	5/15/24	1:30 PM	2:50 PM	300MN B103
Ethan	Villalobos	Technical Paper Publication	130028	Spectral Clustering in Railway Crossing Accidents Analysis	Track 6-2: Rail Grade Crossing Safety	5/14/24	1:30 PM	2:50 PM	300MN B201
Ethan	Villalobos	Technical Paper Publication	130036	Kernel Ridge Regression in Predicting Railway Crossing Accidents	Track 6-2: Rail Grade Crossing Safety	5/14/24	1:30 PM	2:50 PM	300MN B201
Rydell	Walthall	Technical Presentation Only	124334	Model for Optimizing Partial Electrification of a Rail Corridor Using Overhead Supply and Batteries	Track 4-1: Electrification	5/14/24	1:30 PM	2:50 PM	300MN B103
David	Wasilewski	Technical Presentation Only	129801	Leveraging 3d Laser Scanning Data for Track Condition Change Detection	Track 1-4: Condition Monitoring	5/15/24	1:30 PM	2:50 PM	300MN B213
Gavin	Whetstone	Technical Presentation Only	122008	Experimental Evaluation of Crack Evolution in Rails Using a Phased Array	Track 1-1A: Rail	5/14/24	9:00 AM	10:20 AM	300MN B213
Soheil	Yousefnejad	Technical Paper Publication	124493	Fault Detection of a Loose Bolt Connection for Implementation of the DC Series Motor in the Railway Industry by Wavelet	Track 4-1: Electrification	5/14/24	1:30 PM	2:50 PM	300MN B103
Abdul-Rashid	Zakaria	Technical Presentation Only	129728	Robust Artificial Intelligence for Reasoning and Decision-Making in Mitigating Ground Hazards Along Railroads	Track 1-5B: Track Safety	5/15/24	3:30 PM	4:50 PM	300MN B213
Abdul-Rashid	Zakaria	Technical Presentation Only	130514	Enhancing the Safety and Reliability of Railroad Corridors Prone to Geohazards Using a Decision Support System	Track 1-5A: Track Safety	5/15/24	11:00 AM	12:20 PM	300MN B213
Yesenia	Zarate	Technical Paper Publication	124653	Counteracting Freeze-Thaw Deterioration Using Fiber Reinforced Concrete for Railroad Ties	Track 1-3: Railroad Track	5/15/24	9:00 AM	10:20 AM	300MN B213
Jimin	Zhang	Technical Paper Publication	129725	Research on Wheel Wear Coefficient Considering Wheel Profile and Operating Route Based on Multi-Rigid-Body Method	Track 2-2: Rolling Stock and Dynamics	5/14/24	11:00 AM	12:20 PM	300MN B103
Siang	Zhou	Technical Paper Publication	122151	Development of Rail Anchor Testing Through Literature Review of CWR Buckling Resistance Evaluation	Track 1-2: Continuous Welded Rail	5/14/24	11:00 AM	12:20 PM	300MN B213

THE ORGANIZERS THANK EACH OF THE SPEAKERS AND TRACK CHAIRS FOR THEIR WILLINGNESS TO FREELY SHARE THEIR KNOWLEDGE AND EXPERIENCES WITH OUR ATTENDEES. ALSO, WE THANK THE FOLLOWING INDIVIDUALS AND THE ORGANIZATIONS THAT THEY REPRESENT, WHO GENEROUSLY VOLUNTEERED MANY HOURS, THEIR EXPERTISE AND DEDICATION IN PLANNING THIS YEAR'S EVENT.

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University of South Carolina

Constatine Tarawneh
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The University of Texas Rio Grande Valley (UTRGV)
Edinburg, TX

David Thurston
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We would like to extend our gratitude and a big thank you to the University of South Carolina as the Conference Host and strong supporter as well as the University Transportation Center for Railway Safety. Their contributions to the conference have helped make JRC 2024 possible. In particular, Dr. Dimitris Rizos and Dr. Constantine Ta, who both worked tirelessly and were instrumental in organizing the events and details.

Please visit their website below:

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University Transportation Center for Railway Safety (UTCRS)

Website: www.utrgv.edu/railwaysafety

Director: Constantine Tarawneh, Ph.D.

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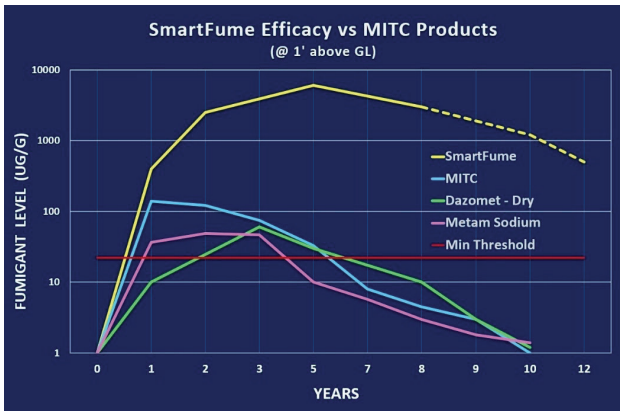

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Reaction completion	Incomplete reaction	Incomplete reaction	No reaction required	No reaction required
Easily uninstalled	✗	✗	✗	✓
Water Requirement	No water required	Requires activator and water	No water required	No water or activator required
Audit and tracking capability	✗	✗	✗	✓
Residual chemical left in hole/tube	None	Significant	Occassionally	None
Made in the USA	✗	✗	✗	✓

Data Sources: Konkler, Morrell, Helsing; "Performance of An Encapsulated Chloropicrin System," Forest Products Jour., 2019 Vol 68 No. 3. Konkler, Cappellazzi, "Performance of Internal Remedial Treatments in Dry Climates," OSU College of Forestry, 2019

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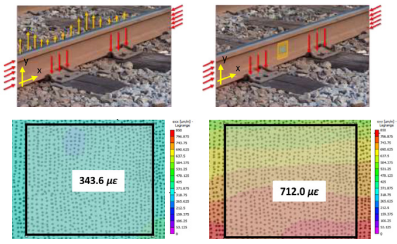
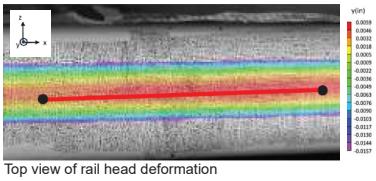


Side view of rail head deformation (top) with color maps of longitudinal & transverse strain fields



Top view of rail head deformation

Rail Neutral Temperature & Strain Measurement with VIC-3D

Precisely determining the rail neutral temperature can help insure the integrity of track and the safety of train operation which makes it important in many rail-based engineering topics, including:

Quantification of the longitudinal stress: Utilizing thermal imaging and three-dimensional digital image correlation to measure full-field temperature and deformation is a critical component to accurately estimate the rail neutral temperature and quantify the longitudinal stress in the rail.

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Rail design: Understanding the location of the neutral axis allows engineers to design rails that can withstand thermal stresses without cracking or buckling.

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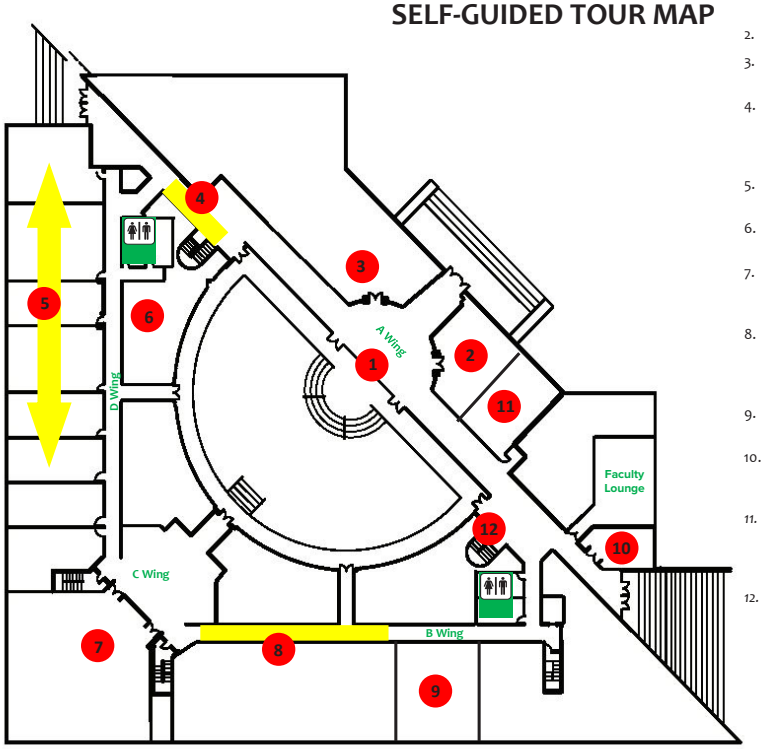
University of South Carolina Site Maps

UofSC Swearingen College of Engineering & Computing

SELF-GUIDED TOUR MAP



1. **Swearingen Lobby** Swearingen (built in 1987) is named after John E. Swearingen, a former USC Chemical Engineering student, class of 1938.
2. **The Wired Cafe** Opened in September 2018.
3. **Student Services - 1A00** Office of Academic Affairs and Academic Advisors.
4. **CEC Student Organizations List & Awards/ Trophies (left wall)** There are currently over 35 different engineering and computing student clubs and organizations in the CEC.
5. **Classrooms/Computer Labs** CEC students have 24/7 access to computers and printing.
6. **Server Room (high performance)** CEC has its own network server for high power and speed.
7. **Amoco Hall/Theater/Classroom - 1C01** Seats about 300; named after Amoco Oil Company (John Swearingen was the former President).
8. **Hall of Undergraduate Research (right wall)** Displayed are results of various undergraduate research projects. CEC students are encouraged to participate in research with faculty.
9. **Teaching Lab - 1B15 (example lab)** Students get hands-on classroom experience with faculty.
10. **CEC Tutoring Lab - 1A07** Peer tutoring - trained tutors are available; only college with its own separate Student Success tutoring branch.
11. **CEC Career Center– 1A03** Full-time staff assist with internships/co-ops, resumes, interviews, and host job fairs; only college with its own separate Career Center branch.
12. **Stairs - 2nd floor** Leads to classrooms in the 2A Hall; the class sizes average about 36:1.

Flip over for more CEC info!

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Swearingen Engineering Center
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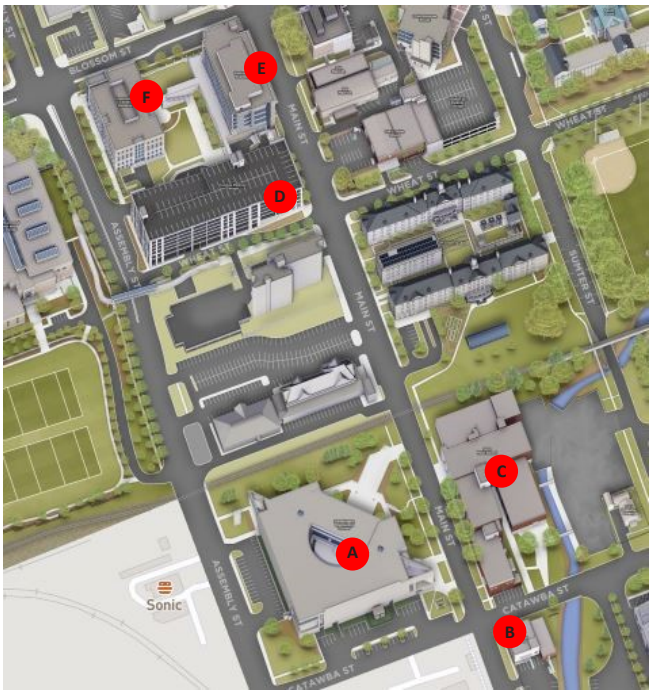
www.cec.sc.edu

UofSC College of Engineering & Computing

MAP OF CEC FACILITIES



Map Key:

A. **Swearingen Center - 301 Main St.** Classrooms, labs and offices; houses the Chemical, Biomedical and Electrical departmental offices.

B. **Catawba Building - 1200 Catawba St.** Biomedical Engineering labs.

C. **300 Main Building - 300 Main St.** Classrooms, labs and offices; houses the Mechanical, Aerospace, Nuclear, Civil & Environmental departmental offices.

D. **Horizon Parking Garage - 519 Main St.** (First Floor) Classrooms.

E. **Horizon Center - 541 Main St.** Offices and research labs.

F. **Horizon II Innovation Center (IBM Building) - Corner of Blossom and Assembly St.** Classrooms and offices; houses the Integrated Information Technology, and Computer Science and Engineering departmental offices.

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- Biomedical, Chemical, and Civil majors have the highest female enrollment.
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- The CEC is currently creating a 3-D Printing makerspace in Swearingen.
- As a freshman, there are no separate applications or requirements to be accepted into the College of Engineering and Computing.

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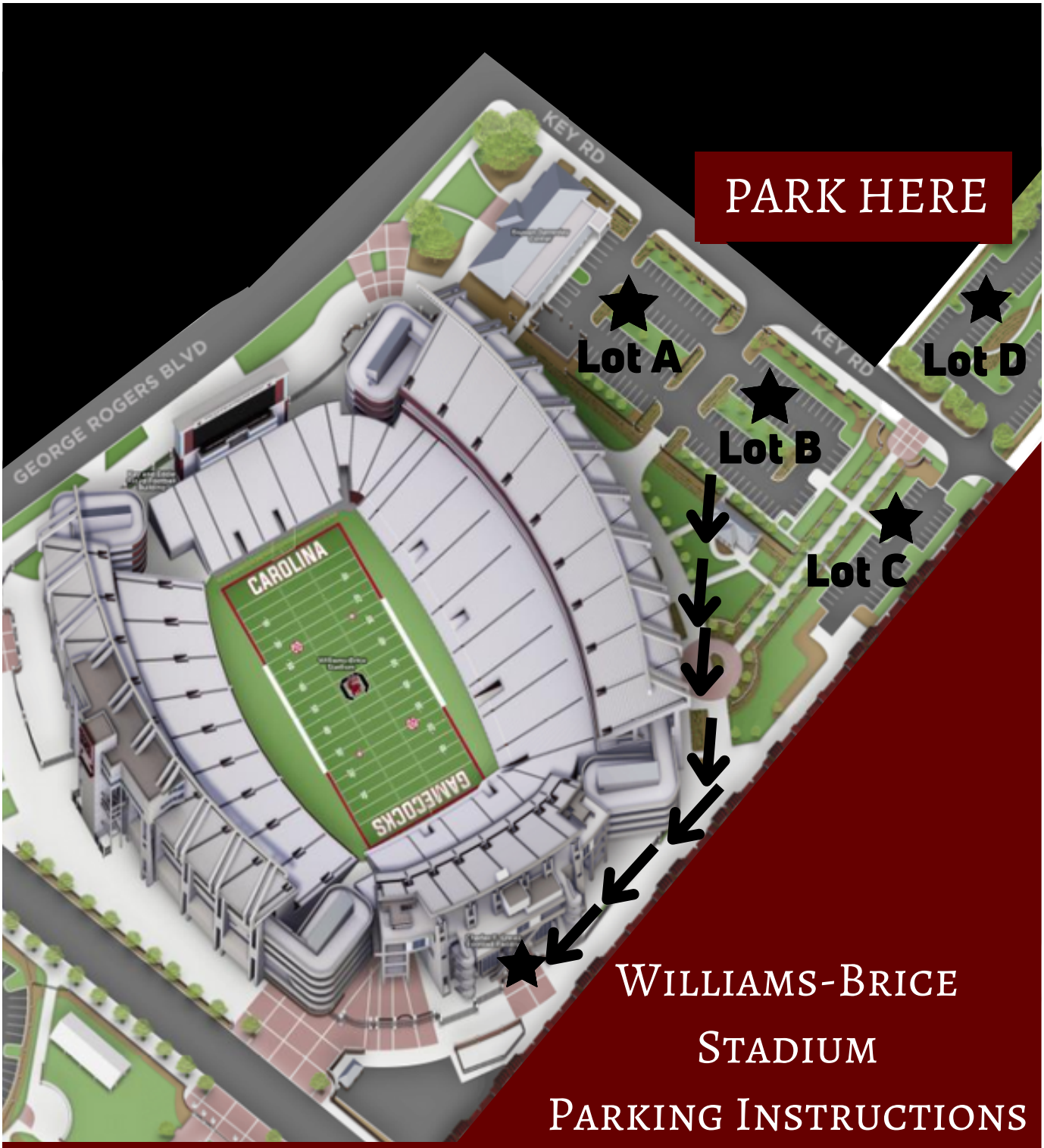

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